

**PATENT**  
**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In Re Application of:

Wessling, Jr., et al.

Confirmation No.: 6200

Serial No.: 10/808,677

Group Art Unit: 3744

Filed: March 25, 2004

Examiner: McCraw, Barry Clayton

Docket No.: 322101.1030

For: Phase Change Material for Temperature Control and Material Storage

**APPEAL BRIEF UNDER 37 C.F.R. §41.37**

Mail Stop Appeal Brief - Patents  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

This Appeal Brief under 37 C.F.R. §41.37 is submitted in support of the Notice of Appeal filed March 12, 2007, responding to the final Office Action of December 12, 2006.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those which may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 C.F.R. §1.136(a), and any fees required therefor (including fees for net addition of claims) are hereby authorized to be charged to Thomas, Kayden, Horstemeyer, & Risley, L.L.P. Deposit Account No. 20-0778.

## **I. REAL PARTY IN INTEREST**

The real party in interest of the instant application is the assignee, the Board of Trustees of the University of Alabama, for and on behalf of the University of Alabama in Huntsville.

## **II. RELATED APPEALS AND INTERFERENCES**

There are no known related appeals and interferences that will affect or be affected by a decision in this appeal.

## **III. STATUS OF THE CLAIMS**

Claims 1-8, 10-13, 15-17, and 21-27 are pending in the present application, and claims 15-17 are allowed. The final Office Action of December 12, 2006, rejected claims 1-3, 10-12, and 21-27 under 35 U.S.C. §102 as allegedly anticipated by *Johnson* (U.S. Patent No. 4,191,125). The final Office Action also rejected claims 4 and 13 under 35 U.S.C. §103 as allegedly unpatentable over *Johnson* in view of *Douglas-Hamilton* (U.S. Patent No. 4,530,816). In addition, the final Office Action rejected claims 5-8 under 35 U.S.C. §103 as allegedly unpatentable over *Hjerstrand* (U.S. Patent No. 4,145,895) in view of *Johnson*, and the final Office Action indicates that claims 15-17 are allowable. Claims 1-8, 10-13, and 21-27 are appealed.

## **IV. STATUS OF AMENDMENTS**

No amendments have been made or requested since the mailing of the final Office Action. A copy of the current claims is attached hereto as Appendix A.

## **V. SUMMARY OF CLAIMED SUBJECT MATTER**

A phase change material of some embodiments, such as that embodied by claim 1, comprises a mixture of water and deuterium oxide (e.g., Paragraph 16, lines 9-11). The mole fraction of deuterium oxide is selected to provide a desired phase change temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius (e.g., Paragraph 21, lines 1-10). The mixture is positioned in close proximity to a biological material such that a temperature of the biological material is maintained near the desired phase change temperature (e.g., Paragraph 21, lines 15-17).

In at least one embodiment, such as that embodied by claim 4, a gel material is added to the mixture (e.g., Paragraph 20, lines 3-4).

A method of some embodiments, such as that embodied by claim 6, comprises the steps of providing a container and positioning a biological material within the container (e.g., Paragraph 4, lines 1-3, and Paragraph 18, lines 13-14). The method further comprises the steps of placing a phase change material in close proximity to the biological material such that a temperature of the biological material is maintained near a phase change temperature of the phase change material (e.g., Paragraph 21, lines 15-17). The phase change material is composed of a mixture of water and deuterium oxide such that the phase change temperature is above zero degrees Celsius and below 3.8 degrees Celsius (e.g., Paragraph 21, lines 1-10).

A method of some embodiments, such as that embodied by claim 7, comprises the step of mixing water and deuterium oxide thereby forming a mixture, wherein the mole fraction of deuterium oxide is selected so the mixture has a desired phase change temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius (e.g., Paragraph 21, lines 1-10). The method further comprises the step of placing the mixture close to a biological material so that a temperature of the biological material is maintained at the desired phase change temperature (e.g., Paragraph 21, lines 15-17).

A treatment pack of some embodiments, such as that embodied by claim 10, is for use in physical therapy in order to maintain live tissue within a desired temperature range (e.g., Paragraph 22, lines 1-7). The treatment pack comprises a pack for holding phase change material (e.g., Paragraph 22, lines 1-7) and a mixture of water and deuterium oxide having a selected mole fraction of deuterium oxide for a desired phase change temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius, wherein the mixture is placed within the pack (e.g., Paragraph 21, lines 1-10, and Paragraph 22, lines 4-7).

In at least one embodiment, such as that embodied by claim 13, a gel material is added to the mixture (e.g., Paragraph 20, lines 3-4).

A method of some embodiments, such as that embodied by claim 21, comprises the steps of providing water and selecting an amount of deuterium oxide to be mixed with the water such that a mixture composed of the selected amount of deuterium oxide and the water has a phase change temperature close to a desired temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius (e.g., Paragraph 21, lines 1-10). The method further comprises the steps of mixing the water and the selected amount of deuterium oxide thereby forming a phase change material (e.g., Paragraph 21, lines 9-10) and positioning the phase change material close to a biological material such that a temperature of the biological material is controlled by the phase change material (e.g., Paragraph 21, lines 15-17).

#### **VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

Claims 1-3, 10-12, and 21-27 are rejected under 35 U.S.C. §102 as allegedly anticipated by *Johnson* (U.S. Patent No. 4,191,125).

Claims 4 and 13 are rejected under 35 U.S.C. §103 as allegedly unpatentable over *Johnson* in view of *Douglas-Hamilton* (U.S. Patent No. 4,530,816).

Claims 5-8 are rejected under 35 U.S.C. §103 as allegedly unpatentable over *Hjerstrand* (U.S. Patent No. 4,145,895) in view of *Johnson*.

## VII. ARGUMENT

### **35 U.S.C. §102 Rejections**

A proper rejection of a claim under 35 U.S.C. §102 requires that a single prior art reference disclose each element of the claim. See, e.g., *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983).

### **Discussion of Rejections of Claims 1-3, 5, 10-12, and 22-27**

Claim 1 presently stands rejected in the final Office Action under 35 U.S.C. §102 as allegedly anticipated by *Johnson* (U.S. Patent No. 4,191,125). Claim 10 comprises similar claimed limitations which are missing from *Johnson* as claim 1. Claims 2, 3, 5, and 22-27 depend from claim 1, and claims 11 and 12 depend from claim 10. Therefore, claim 1 is discussed below as an exemplary claim for discussion.

Claim 1 reads as follows:

1. A phase change material, comprising:  
a mixture of water and deuterium oxide *wherein the mole fraction of deuterium oxide is selected to provide a desired phase change temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius*, wherein the mixture is positioned in close proximity to a biological material such that a temperature of the biological material is maintained near the desired phase change temperature. (Emphasis added).

Applicants respectfully assert that *Johnson* fails to disclose at least the features of claim 1 highlighted hereinabove. Thus, the 35 U.S.C. §102 rejection of claim 1, as amended, is improper.

In this regard, *Johnson* appears to disclose a "freeze indicator" that apparently uses a mixture of deuterium oxide and water to provide a material that freezes between negative (-) 4 degrees Celsius and 0 degrees Celsius. See column 2, lines 65-68. Thus, *Johnson* fails to disclose "a mixture of water and deuterium oxide wherein the mole fraction of deuterium oxide

is selected to provide a desired phase change temperature in a range **above zero degrees Celsius** and below 3.8 degrees Celsius," as recited by claim 1. (Emphasis added).

In rejecting claim 1, it is asserted in the final Office Action that:

"Applicant's arguments filed 9/25/2006 have been fully considered but they are not persuasive. The applicant argues that the Johnson reference fails to teach a mixture of water and deuterium oxide that provides a desired phase change temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius. The examiner respectfully disagrees. Column 2, lines 57-68 clearly illustrate the fact that deuterium oxide has a normal freezing point of around 4 degrees Celsius and various amounts of water can be added to create a freezing point anywhere from there, all the way down to negative 4 degrees Celsius. As shown by the statements 'the freeze point of the mixture may be raised accordingly to accommodate particular needs' and 'in order to tune the device so that an indication is given for a predetermined temperature, an amount of deuterium oxide may be added to the water,' it is clear that the subrange that the applicant provides which is within the range that Johnson explains would be obvious to one of ordinary skill in the art by routine experimentation."

*Johnson* does disclose adding deuterium oxide to water in order to raise the phase change temperature but specifically discloses the range to be between minus (-) 4 degrees Celsius and 0 degrees Celsius. Although *Johnson* discloses that pure deuterium oxide has a normal freeze point around 4 degrees Celsius, there is nothing in *Johnson* to indicate that pure deuterium oxide should be used in the disclosed "freeze indicator" or that any mixture providing a phase change temperature above 0 degrees Celsius should be used. For the mixture disclosed by *Johnson*, only a range between minus (-) 4 degrees Celsius and 0 degrees Celsius is disclosed, and whether or not it may be "obvious" to try ranges outside of the disclosed range is not relevant to an inquiry under 35 U.S.C. §102. Indeed, a rejection under 35 U.S.C. §102 is proper only if "each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. V. Union Oil Co. of California*, 814 F.2d 628, 631, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987).

Furthermore, even if one were to consider whether it would be "obvious" to try ranges outside of the disclosed range, Applicants submit that a range between 0 degrees Celsius and 4 degrees Celsius is not "obvious." In this regard, it is clear that the purpose of the "freeze indicator" disclosed in *Johnson* is to provide an indication of when a freezing temperature (*i.e.*,

a temperature at or below 0 degrees Celsius) has been reached. *Johnson* discloses that by adding deuterium oxide an "undercooling effect," which causes water to freeze below 0 degrees Celsius, can be compensated thereby giving a more precise indication when the freezing point has been reached. See column 2, lines 37-40 and 63-65. At no point is it contemplated that the mixture should, for any reason, have a phase change temperature above 0 degrees Celsius. Alleging that ranges above 0 degrees Celsius would be "obvious" based on the teachings of *Johnson* fails to consider such teachings as a whole and is, in fact, contrary to the stated purpose of *Johnson*.

For at least the above reasons, Applicants respectfully assert that *Johnson* fails to disclose each feature of claim 1. Therefore, the 35 U.S.C. §102 rejection of claim 1 should be overruled.

#### **Discussion of 35 U.S.C. §102 Rejection of Claim 21**

Claim 21 presently stands rejected in the final Office Action under 35 U.S.C. §102 as allegedly anticipated by *Johnson*. Claim 21 reads as follows:

21. A method comprising the steps of:  
providing water;  
***selecting an amount of deuterium oxide to be mixed with the water such that a mixture composed of the selected amount of deuterium oxide and the water has a phase change temperature close to a desired temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius;*** and  
mixing the water and the selected amount of deuterium oxide thereby forming a phase change material; and  
positioning the phase change material close to a biological material such that a temperature of the biological material is controlled by the phase change material. (Emphasis added).

For at least reasons similar to those set forth above in the Discussion of Rejections of Claims 1-3, 5, 10-12, and 22-27, Applicants respectfully submit that *Johnson* fails to disclose at least the features of claim 21 highlighted above.

In addition, *Johnson* fails to indicate that the material of the "freeze indicator" is positioned close to a biological material. Thus, *Johnson* fails to disclose "positioning the phase

change material close to a biological material such that a temperature of the biological material is controlled by the phase change material,” as recited by claim 21.

In rejecting claim 21, it is alleged in the final Office Action that:

“Regarding claim 21, the phase, ‘positioning the phase change material close to a biological material such that a temperature of the biological material is controlled by the phase change material,’ is the material’s intended use, and is not a functional limitation of the material itself, and therefore holds limited patentable weight.”

Applicants submit that there is no basis for the Patent Office to limit, **for a method claim**, the patentable weight of a limitation that is directed to a material’s “intended use.” Thus, even if the “positioning” step is directed to the “material’s intended use,” as alleged in the Office Action, the step nevertheless can be used to distinguish the claimed invention from the cited art. Further, it does not appear that it is even alleged in the Office Action that *Johnson* discloses the “positioning” step recited by claim 21.

For at least the above reasons, Applicants respectfully assert that *Johnson* fails to disclose each feature of claim 21, and the 35 U.S.C. §102 rejection of claim 21 should be overruled.

### **35 U.S.C. §103 Rejections**

In order for a claim to be properly rejected under 35 U.S.C. §103, the combined teachings of the prior art references must suggest all features of the claimed invention to one of ordinary skill in the art. See, e.g., *In Re Dow Chemical Co.*, 837 F.2d 469, 5 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1988), and *In re Keller*, 642 F.2d 413, 208 U.S.P.Q. 871, 881 (C.C.P.A. 1981). In addition, “(t)he PTO has the burden under section 103 to establish a *prima facie* case of obviousness. It can satisfy this burden only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references.” *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988) (Citations omitted). Furthermore, the Federal Circuit has stated that “(i)t is impermissible, however, to simply engage in hindsight reconstruction of

the claimed invention, using the applicant's structure as a template and selecting elements from references to fill the gaps." *In re Gorman*, 933 F.2d 982, 987, 18 U.S.P.Q.2d 1885 (1991).

#### **Discussion of 35 U.S.C. §103 Rejections of Claims 4 and 13**

Claim 4 presently stands rejected in the final Office Action under 35 U.S.C. §103 as allegedly unpatentable over *Johnson* in view of *Douglas-Hamilton* (U.S. Patent No. 4,530,816). Claim 13 comprises similar claimed limitations as claim 4. Therefore, claim 4 is discussed below as an exemplary claim for discussion.

In rejecting claim 4, it is asserted in the Office Action that:

"Johnson teaches the elements of the invention as described above, but fails to teach a gel material added to the mixture. Douglas-Hamilton explicitly teaches a gel material added to the mixture (col. 2, lines 66-67). It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the phase change material of Johnson with the gel material of Douglas-Hamilton because adding gel to a thermal mixture increases the thermal capacity of the mixture."

Applicants respectfully assert that there is nothing in the cited art to indicate that it would be desirable to "increase the thermal capacity of the mixture" of the "freeze indicator" disclosed by *Johnson*. Indeed, the primary purpose of *Johnson* appears to be for indicating when a freezing temperature has been reached. Moreover, *Johnson* does not appear to be concerned with maximizing or trying to increase the amount of heat being absorbed, and there would be no apparent reason for adding a gel mixture in order to "increase the thermal capacity of the mixture," as alleged in the Office Action. Thus, the Office Action fails to establish a *prima facie* case of obviousness.

In addition, for at least the reasons set forth above in the Discussion of Rejections of Claims 1-3, 10-12, and 22-27, Applicants respectfully submit that claims 1 and 10 are allowable. Further, claims 4 and 13 respectively depend from claims 1 and 10. Thus, claims 4 and 13 are allowable as a matter of law. *In re Fine*, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

For at least the above reasons, Applicants respectfully assert that the 35 U.S.C. §103 rejection of claim 4 should be overruled.

**Discussion of 35 U.S.C. §103 Rejection of Claims 6-8**

Claim 6 presently stands rejected in the final Office Action under 35 U.S.C. §103 as allegedly unpatentable over *Hjertstrand* in view of *Johnson*. Claim 7 comprises similar claimed limitations which are missing from the alleged combination of *Hjertstrand* and *Johnson* as claim 1. Claim 8 depends from claim 7. Therefore, claim 6 is discussed below as an exemplary claim for discussion.

Applicants respectfully assert that the final Office Action fails to establish that it would have been obvious to combine the select teachings of *Hjertstrand* with the select teachings of *Johnson*, and the 35 U.S.C. §103 rejection of claim 6 is, for at least this reason, improper.

In this regard, Applicants observe that neither *Johnson* nor *Hjertstrand* suggests a mixture of deuterium oxide and water having a phase change temperature above zero degrees Celsius and below 3.8 degrees Celsius. In particular, *Johnson* suggests the use of a mixture of deuterium oxide and water but specifically teaches that the mixture is to have a phase change temperature between negative (-) 4 degrees Celsius and 0 degrees Celsius. See column 2, lines 65-68. Further, *Hjertstrand* apparently suggests the use of various phase change materials for maintaining a material at a desired temperature. However, *Hjertstrand* fails to provide any reason or motivation for using a mixture of water and deuterium oxide in lieu of the materials specifically suggested therein. Accordingly, the combination is inadequate to suggest "placing a phase change material in close proximity to the biological material such that a temperature of the biological material is maintained near a phase change temperature of the phase change material, ***the phase change material composed of a mixture of water and deuterium oxide such that the phase change temperature is above zero degrees Celsius and below 3.8 degrees Celsius,***" as recited by amended claim 6.  
(Emphasis added).

Furthermore, when a claimed invention is rejected under 35 U.S.C. §103 by combining the teachings of multiple prior art references, the Patent Office can satisfy its burden of establishing a *prima facie* case of obviousness "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references." *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). Indeed, "that features, even distinguishing features, are 'disclosed' in the prior art is alone insufficient. As above indicated, it is common to find elements or features somewhere in the prior art. Moreover, most if not all elements perform their ordained and expected function. The test is whether the claimed invention as a whole, in light of all the teachings of the references in their entirieties, would have been obvious to one of ordinary skill in the art at the time the invention was made. *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1949, 220 U.S.P.Q. 193 (Fed. Cir. 1983). Applicants respectfully assert that when the cited art is properly considered as a whole, it is apparent that one of ordinary skill in the art would not have been motivated to combine the select teachings of *Johnson* and *Hjertstrand*, and the 35 U.S.C. §103 rejection of claim 6 is improper for at least this reason.

In this regard, in rejecting claim 6, it is asserted in the Office Action that:

"It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the container of *Hjertstrand et al.* With the phase change material of *Johnson* because deuterium oxide enables the container to maintain specific temperature range of approximately 0-5 degrees Celsius, with the proper mixture determined through experimentation (col. 2, lines 57-65)."

However, Applicants observe that the material of *Johnson* does not maintain the specific range of approximately 0-5 degrees. Instead, as set forth above in the Discussion of Rejections of Claims 1-3, 5, 10-12, and 22-27, *Johnson* specifically teaches that a temperature range between negative (-) 4 degrees Celsius and 0 degrees Celsius is maintained. See column 2, lines 65-68. Moreover, the Office Action fails to establish that the cited art provides a sufficient reason or motivation for combining the select teachings of *Johnson* and *Hjertstrand* and,

therefore, fails to establish a *prima facie* case of obviousness. "Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references." *In re Dembicczak*, 175 F.3d 994, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999).

Furthermore, where there is no apparent disadvantage present in a particular prior art reference, then generally there can be no motivation to combine the teaching of another reference with the particular prior art reference. *Winner Int'l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349, 53 U.S.P.Q.2d 1580 (Fed. Cir. January 27, 2000). Applicants submit that there is no apparent deficiency in *Hjertstrand* or *Johnson* that would motivate one of ordinary skill in the art to combine the select teachings of any one of the references with the other. Indeed, it appears that the specific phase change materials suggested by *Hjertstrand* sufficiently enable temperatures in the container to be maintained within the alleged range (i.e., 0 to 5 degrees Celsius), and there is no apparent reason for one of ordinary skill in the art to seek the "freeze indicator" teachings of *Johnson* when implementing the container described by *Hjertstrand*.

In addition, since *Johnson* teaches a temperature range (i.e., negative (-) 4 degrees Celsius to 0 degrees Celsius) outside of the acceptable temperature range suggested by *Hjertstrand*, Applicants submit that *Johnson* teaches away from and, therefore, should not be combined with the teachings of *Hjertstrand*. In fact, freezing temperatures can damage many biological materials making phase change materials with a phase change temperature at or below freezing (i.e., at or below zero degrees Celsius) undesirable. Thus, one of ordinary skill in the art would be discouraged from consulting a reference, such as *Johnson*, describing a "freeze indicator" for possible materials in selecting a phase change material to be used with biological matter. In particular, one of ordinary skill in the art would expect that materials for a "freeze indicator" to have phase change properties below the acceptable range for many biological materials. "(P)rior art references before the tribunal must be read as a whole and consideration must be given where the references diverge and teach away from the claimed

invention." *Akzo N.V. v. U.S. International Trade Commission*, 808 F.2d 1471, 1481, 1 U.S.P.Q.2d 1291 (Fed. Cir. 1986), *cert denied*, 482 U.S. 909. Moreover, when the cited art is properly viewed as a whole, including the portions that diverge and teach away from the invention, it becomes apparent that the alleged combination is not properly based on the teachings of the cited art but is instead based on impermissible hindsight reconstruction of Applicants' invention.

For at least the above reasons, Applicants respectfully submit that the 35 U.S.C. §103 rejection of claim 6 is improper and should be withdrawn.

### **CONCLUSION**

Based on the foregoing discussion, Applicant respectfully requests that the Examiner's final rejections of claims 1-8, 10-13, 15-17, and 21-27 be overruled and withdrawn by the Board, and that the application be allowed to issue as a patent with all pending claims.

Respectfully submitted,

**THOMAS, KAYDEN, HORSTEMEYER  
& RISLEY, L.L.P.**

By:



\_\_\_\_\_  
Jon E. Holland  
Reg. No. 41,077  
(256) 704-3900 Ext. 103

100 Galleria Parkway  
Suite 1750  
Atlanta, GA 30339

## VIII. CLAIMS - APPENDIX

1. A phase change material, comprising:

a mixture of water and deuterium oxide wherein the mole fraction of deuterium oxide is selected to provide a desired phase change temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius, wherein the mixture is positioned in close proximity to a biological material such that a temperature of the biological material is maintained near the desired phase change temperature.

2. The phase change material of claim 1 wherein a nucleating agent is added to the mixture.

3. The phase change material of claim 1 wherein a colorant is added to the mixture.

4. The phase change material of claim 1 wherein a gel material is added to the mixture.

5. The phase change material of claim 1 wherein a temperature depression material is added to the mixture.

6. A method, comprising the steps of:  
providing a container;  
positioning a biological material within the container; and  
placing a phase change material in close proximity to the biological material such  
that a temperature of the biological material is maintained near a phase change temperature  
of the phase change material, the phase change material composed of a mixture of water  
and deuterium oxide such that the phase change temperature is above zero degrees  
Celsius and below 3.8 degrees Celsius.

7. A method, comprising the steps of:  
mixing water and deuterium oxide thereby forming a mixture, wherein the mole  
fraction of deuterium oxide is selected so the mixture has a desired phase change  
temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius; and  
placing the mixture close to a biological material so that a temperature of the  
biological material is maintained at the desired phase change temperature.

8. The method of claim 7 wherein the biological material and mixture are thermally  
isolated from the environment.

9. (Canceled)

10. A treatment pack for use in physical therapy in order to maintain live tissue within a desired temperature range, comprising:
- a pack for holding phase change material; and
- a mixture of water and deuterium oxide having a selected mole fraction of deuterium oxide for a desired phase change temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius, wherein the mixture is placed within the pack.
11. The treatment pack of claim 10 wherein the pack is shaped to conform for a desired treatment.
12. The treatment pack of claim 10 wherein a colorant is added to the mixture.
13. The treatment pack of claim 10 wherein a gel is added to the mixture.
14. (Canceled)
15. A material that changes phase at a desired temperature between approximately zero degrees Celsius and four degrees Celsius comprising:
- water; and
- deuterium oxide wherein a mole fraction of deuterium oxide is chosen so that the phase change temperature of the material is the desired temperature,
- wherein the mole fraction is chosen according to the approximate equation, desired temperature =  $3.8 * \text{mole fraction of deuterium oxide}$ .

16. A material that changes phase at a desired temperature between approximately zero degrees Celsius and four degrees Celsius comprising:

water; and

deuterium oxide wherein a mole fraction of deuterium oxide is chosen so that the phase change temperature of the material is the desired temperature,

wherein the material, when in a solid phase, is crushed and serves as a slurry for surrounding a temperature sensitive material.

17. The material of claim 15 wherein the material is used in a treatment pack.

18-20. (Canceled)

21. A method comprising the steps of:

providing water;

selecting an amount of deuterium oxide to be mixed with the water such that a mixture composed of the selected amount of deuterium oxide and the water has a phase change temperature close to a desired temperature in a range above zero degrees Celsius and below 3.8 degrees Celsius; and

mixing the water and the selected amount of deuterium oxide thereby forming a phase change material; and

positioning the phase change material close to a biological material such that a temperature of the biological material is controlled by the phase change material.

22. The phase change material of claim 1 wherein the biological material comprises a protein.

23. The phase change material of claim 1 wherein the biological material comprises an organ.

24. The phase change material of claim 1 wherein the biological material comprises blood.

25. The phase change material of claim 1 wherein the biological material comprises urine samples.

26. The phase change material of claim 1 wherein the biological material comprises vaccines.

27. The phase change material of claim 1 wherein the biological material comprises living tissue.

**IX. EVIDENCE - APPENDIX**

None.

**X. RELATED PROCEEDINGS - APPENDIX**

None.